WHAT IS CLAIMED IS:

1 A method for in-situ and real-time plasma chamber condition monitoring, comprising:

injecting a probing gas into a plasma chamber;

striking the probing gas into a probing plasma;

measuring the emission intensities of free radicals in the probing plasma; and

determining whether to continue a plasma process on the basis of the measured emission intensities.

2 The method of claim 1 wherein the probing plasma includes at least a free radical such as Br, Cl, O or F, preferably Br, and an inert gas molecule.

3 The method of claim 2 wherein the inert gas molecule accounts for 5%-10% of the probing plasma.

4 The method of claim 2 wherein the density of a free radical in the probing plasma is defined as the ratio of emission intensities between the free radical and the inert gas molecule.

5 The method of claim 4 wherein the free radical density is compared with a first predefined level.

6 The method of claim 5 wherein if the free radical density is below the first predefined level, the plasma chamber is taken off production.

7 The method of claim 4 wherein the free radical density is compared with a second predefined level.

8 The method of claim 7 wherein if the free radical density is above the second predefined level, the plasma chamber is brought back to production.

9 The method of claim 1 wherein the free radicals in the probing plasma include at least one of Br, Cl, O or F.

10 The method of claim 1 wherein the probing plasma also includes at least one of Ar or Xe.

11 A method for detecting over-seasoning in a plasma chamber comprising:

injecting a seasoning gas into a plasma chamber;

striking the seasoning gas into a seasoning plasma;

measuring the emission intensities of free radicals in the seasoning plasma; and

determining if the plasma chamber is over-seasoned or not according to the measured emission intensities.

12 The method of claim 11 wherein the seasoning plasma includes at least a free radical such as Br, Cl, O, or F, preferably F, and an inert gas molecule.

13 The method of claim 12 wherein the inert gas molecule accounts for 5%-10% of the seasoning plasma.

14 The method of claim 12 wherein the density of a free radical in the seasoning plasma is defined as the ratio of emission intensities between the free radical and the inert gas molecule.

15 The method of claim 14 wherein the free radical density is compared with a predefined level.

16 The method of claim 15 wherein if the free radical density is above the predefined level, the chamber seasoning is deemed to be complete.

17 The method of claim 11 wherein the free radicals in the probing plasma include at least one of Br, Cl, O or F.

18 The method of claim 17 wherein the probing plasma also includes at least one of Ar or Xe.

19 A method for detecting process drift in a plasma chamber comprising:

injecting a process gas into a plasma chamber;

striking the process gas into a process plasma;

measuring the emission intensities of free radicals in the process plasma; and

determining the extent of process drift according to the measured emission intensities.

20 The method of claim 19 wherein the process plasma includes at least a free radical and an inert gas molecule.

21 The method of claim 20 wherein the inert gas molecule accounts for 5%-10% of the seasoning plasma.

22 The method of claim 20 wherein the density of a free radical in the process plasma is defined as the ratio of emission intensities between the free radical and the inert gas molecule.

23 The method of claim 2 wherein the free radical density is compared with a predefined level.

24 The method of claim 23 wherein if the free radical density is below the predefined level, the plasma chamber is deemed to be unsuitable for production wafer etching.

25 The method of claim 19 wherein the free radicals in the probing plasma include at least one of Br, Cl, O or F.

26 The method of claim 25 wherein the probing plasma also includes at least one of Ar or Xe.

27 A computer system for in-situ and real-time plasma chamber condition monitoring, comprising:

at least one central processing unit;

a memory; and

at least one support circuit connecting the at least one central processing unit and the memory with a plasma chamber;

the memory further including a plasma chamber condition monitor, wherein the plasma chamber monitor includes instructions for:

measuring the emission intensities of free radicals in the plasma chamber; and

determining whether to continue a plasma process on the basis of the measured emission intensities.

28 The computer system of claim 27 wherein the free radical density is compared with a first predefined level.

29 The computer system of claim 28 wherein if the free radical density is below the first predefined level, the plasma chamber is taken off production in the case of production wafer etching.

30 The computer system of claim 27 wherein the free radical density is compared with a second predefined level.

31 The computer system of claim 30 wherein if the free radical density is above the second predefined level during chamber seasoning the plasma chamber is brought back to production.